

Net zero target: implications for real earnings management

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Abstract

Purpose – This study aims to investigate the impact of country net zero target commitment on real earnings management (REM) of listed firms in response to global climate change risk. In addition, this study also examines the moderating effect of corporate social responsibility (CSR) on the relationship between country net zero target commitment and REM.

Design/methodology/approach – This study uses a sample of 249,711 firm-year observations of listed firms across 71 countries from 2011 to 2021. Following prior literature, the authors use four measures of REM: abnormal cash flow from operations, abnormal discretionary expenses, abnormal production costs and the sum of the three aforementioned measures.

Findings – The authors find that REM is higher in firms headquartered in countries that have committed to a net zero target. Moreover, the authors document that REM activities are less prevalent when firms voluntarily commit to a net zero target and demonstrate high CSR performance. Results suggest that these firms are better equipped to navigate the regulatory changes imposed by their headquarter countries.

Research limitations/implications – The findings are informative to the firms' insiders, investors and regulators in relation to the potential risks that arise due to managers' discretionary choice in using REM as a strategy to achieve both the net zero target preparations and the desired earnings outlook. More importantly, the findings provide insights to investors and analysts in helping them to assess the true value of firms. In particular, many countries are now racing to achieve a net zero target, which may cause economic trade-offs between achieving the net zero target and the financial implications on firms due to these regulatory changes.

Originality/value – The findings are informative to firms' insiders, investors and regulators in relation to the potential risks that arise due to managers' discretionary choice in using REM as a strategy to achieve both the net zero target preparations and the desired earnings outlook. More importantly, the findings provide insights to investors and analysts in helping them to assess the true value of firms. In particular, many countries are now racing to achieve a net zero target, which may cause economic trade-offs between achieving the net zero target and the financial implications on firms due to these regulatory changes.

Keywords Corporate social responsibility, Global risk challenges, Net zero target, Real earnings management, Regulatory shock

Paper type Research paper



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1. Introduction

The adverse impact of climate change and extreme weather events has been well-documented in the literature (see, e.g. [Do et al., 2021](#); [Huynh et al., 2020](#); [Shan and Gong, 2012](#); [Truong et al., 2020](#)) [1]. Climate change is a major global risk challenge due to its widespread and interconnected impacts on the environment, economy, health and security. In mitigating the adverse impact of climate change on human well-being and the environment, the Paris Agreement (COP21) proposed a 45% decrease in CO₂ emissions by 2030 and a net zero carbon emissions target, hereafter referred to as a net zero target by 2050 ([United Nations, 2022](#)). Given that the net zero target has become a global rallying cry and requires substantial financial support, it is crucial to investigate the economic outcomes and/or consequences for firms that commit to moving toward the net zero targets. As such, this study examines the real earnings management (REM) among firms subjected to regulatory changes associated with countries committing to a net zero target in which firms are headquartered.

From a theoretical perspective, there are three mechanisms through which national-level net zero commitments can influence managers' REM decisions, namely, regulatory uncertainty and anticipated compliance costs, legitimacy pressures and stakeholder scrutiny and capital market expectations and transition risk pricing. First, national commitment to the net zero targets should signal to firms the likelihood of more stringent regulatory measures (e.g. carbon pricing, mandatory disclosure or industry-specific transition plans). This, in turn, creates uncertainty about future operating costs and performance benchmarks, and such uncertainty incentivizes managers to use REM to present a smoother earnings trajectory ([Francis et al., 2004](#); [Ilhan et al., 2023](#)). Second, firms headquartered in countries with formal net zero targets should face heightened legitimacy threats if they are perceived as lagging in climate preparedness ([Suchman, 1995](#); [Patten, 2002](#)). Managers may respond by engaging in REM to demonstrate short-term resilience, particularly in carbon-intensive sectors. Finally, there is strong evidence that investors in global capital markets increasingly factor national climate commitments into risk assessments and capital allocation ([Bolton and Kacperczyk, 2021](#); [Krueger et al., 2020](#)). Thus, managers may engage in REM to meet heightened performance expectations under climate-constrained scenarios.

There is ample evidence that eliminating excessive carbon emissions requires substantial costs and significant funding, as operational transformations are necessary. It is crucial to consider how firms operating in countries that have committed to a net zero target would finance the operational changes needed to align with the target reduction in carbon emissions. From a managerial perspective, countries exert significant pressure on firms to contribute to moving toward the net zero targets [2]. Therefore, in transitioning to the net zero targets, managers of firms headquartered in countries that have committed to a net zero target could engage in REM.

REM activities provide ideal research setting for our empirical examination as they are relatively easier for managers to manage. Managers can use their operational and long-term investment discretion to engage in REM activities at any time during the financial year. Prior studies find that managers could use REM activities to provide cash savings, and simultaneously improve the firm's current earnings outlook as a result of the reduction in capital expenditures or expenses related to those projects ([Baber et al., 1991](#); [Bushee, 1998](#); [Graham et al., 2005](#)). This cash availability could be used to finance investments in new technologies and infrastructure systems in the coming years that allow firms to reduce their carbon emissions [3]. In the context of net zero targets, managers could also engage in REM activities by reducing current capital expenditures

and R&D that are less likely to have a direct effect on reducing carbon emissions and achieving net zero targets. These REM activities could provide cash savings, which may be used to finance new technologies and infrastructure systems in preparing firms to commit to a net zero target.

Based on the above notions, we investigate whether firms headquartered in countries that have committed to a net zero target engage more in REM. We predict that in achieving both a net zero target and a desired earnings outlook, firms headquartered in countries that have committed to a net zero target exhibit higher levels of REM. In addition, we also investigate whether corporate social responsibility (CSR) performance significantly affects the association between REM and the commitment to move toward a net zero target. The effect of CSR in relation to the net zero targets is particularly important given the growing concerns about firms' sustainability (Mackey *et al.*, 2007; Margolis and Walsh, 2003). The relation between CSR performance and REM is not intuitively straightforward. On the one hand, prior studies find that good CSR enhances a firm's performance, thereby providing less incentive for managers to manage earnings via REM (Hong and Andersen, 2011; Kim *et al.*, 2012; Scholtens and Kang, 2013). Conversely, other studies find that firms require substantial funds to enhance their CSR performance through various activities, thereby inducing managers to engage in more earnings management via REM (Boukattaya and Halaoua, 2022; Kim *et al.*, 2019; Kuo *et al.*, 2021). Due to the inconclusive findings on the association between CSR performance and REM, we conjecture that CSR performance has no significant effect on the association between firms' REM and net zero target commitment.

To test these conjectures, we use a sample of firms listed on stock exchanges across 71 countries from 2011 to 2021, for which financial data are available in the Compustat Global and Worldscope databases. Using a sample of 249,711 firm-year observations, our results indicate that firms headquartered in countries that have committed to the net zero targets engage in more REM activities. Our results are consistent for all four measures of REM activities. In addition, our findings show that this relation is weaker in firms with better CSR, which is an indication of a firm's readiness and willingness to align with the objectives associated with the net zero target commitment. The results are robust to alternative measures of REM and employment of the propensity score matching (PSM) methodology. We also use four levels of net zero target commitments to determine the intensity at the country level and find REM increases with an increase in the intensity of the net zero target commitment. Finally, we find that firms that voluntarily commit to the net zero targets do not exhibit higher REM, consistent with the notion that such firms are better prepared to respond to the regulatory changes imposed by the country where they are headquartered.

Our study makes several important contributions to the literature and practice in the following ways. First, our study contributes to the growing literature on how macrolevel climate policy can have microlevel reporting consequences on firms. While prior research has examined the effects of climate regulation on investment behavior (D'Arcangelo *et al.*, 2023; Grewal *et al.*, 2019), disclosure (Christensen *et al.*, 2021), corporate innovation (Liu *et al.*, 2024) or financing activities (Nguyen *et al.*, 2025), to the best of our knowledge no study has directly linked national net zero target commitment, a cornerstone of global climate governance, to managers' REM decisions. This unique linkage allows us to provide new insights into how global climate commitments shape firm-level financial reporting incentives.

REM is particularly salient in the context of net zero targets because, unlike accrual-based earnings management, it operates through real business decisions such as reducing R&D,

delaying investments or cutting discretionary spending. Focusing on REM, we uncover a subtle but economically significant channel through which national climate commitments may unintentionally incentivize short-term profit preservation at the expense of long-term sustainability. This unique perspective allows us to highlight the tension between global net zero targets and firm-level financial reporting incentives, offering insights into microlevel externalities of climate macro policies.

Second, our study provides evidence of important differentiation between national-level and firm-level commitments in the context of net zero targets. Existing work often focuses on firm voluntary initiatives (e.g. voluntary carbon disclosure, internal carbon pricing or CSR commitments). Our paper highlights how country-level regulatory pressure cascades down to firm reporting practices, even in the absence of immediate enforcement. This is a novel angle that bridges the macrolevel policy literature with the microlevel accounting and the REM literature. In addition, we also contribute methodologically by constructing the intensity variable that captures not only whether a country has committed to a net zero target but also the strength of its commitment (law, policy, pledge, or proposal). This allows us to empirically differentiate between “symbolic” commitment and “substantive” commitment, providing richer evidence than a binary treatment indicator often used in the literature.

Third, our study also contributes to the CSR literature by showing that firms with higher CSR performance are in a better position to deal with the financial challenges as a result of the regulatory shocks imposed by governments in meeting the net zero targets, leading to a reduced likelihood of REM activities. Our findings demonstrate to corporate stakeholders and activists that higher levels of CSR performance play an important role in mitigating the impact of a country’s net zero target commitment on firms’ REM activities.

Finally, our findings are informative to firms’ insiders, investors and regulators in relation to the potential risks that arise due to managers’ discretionary choice in using REM as a strategy to achieve both the net zero target preparations and the desired earnings outlook. More importantly, the findings provide insights to investors and analysts in helping them to assess the true value of firms. In particular, many countries are now racing to achieve a net zero target, which may cause economic trade-offs between achieving the net zero target and the financial implications of the regulatory changes imposed on corporate entities.

Prior studies (Roychowdhury, 2006; Dechow and Sloan, 1991; Baber *et al.*, 1991; Bushee, 1998) have demonstrated how opportunistic managers could use their discretion to engage in REM in maximizing their utility. In the context of our study, REM activities could help firms achieve the transformation required to support the net zero targets in the countries where they are headquartered, while satisfying a desired earnings outlook. However, from the perspective of investors, higher levels of firms’ REM activities could be value-destructive in the long run. Hence, our findings inform stakeholders, particularly investors, so they can exercise caution to closely monitor and evaluate how those firms that are committed to the net zero targets mitigate the negative impact of their REM activities.

The remainder of the paper is structured as follows. Section 2 discusses the literature related to the development of hypotheses. Section 3 presents the research design and data in this study, including the sample selection process, all variables and regression models. The primary empirical results are presented in Section 4, followed by robustness checks and additional analyses in Section 5. Section 6 concludes this study.

2. Literature review and hypotheses development

2.1 *Financial implications of the net zero target commitment*

In 2015, 196 sovereign nations signed the Paris Agreement (COP21) with the objective of limiting the rise of global temperature to 1.5°C. This is a substantial challenge for countries to meet the Paris Agreement's target because they need to reduce CO₂ emissions by 45% by 2030 and achieve the net zero target by 2050 (United Nations, 2022). The Energy & Climate Intelligence Unit (2022) reports that 126 global countries and regions, excluding the USA, have committed to achieving the net zero target with varying years and levels of commitment. The variations include enshrined in law, outlined in official policy documents, declared or pledged and under discussion or proposed. To achieve a net zero target, countries are required to transform their economy and industry, which involves collaboration from various sectors (PwC Global, 2022).

The heightened policies in achieving the net zero targets could result in firms with regulatory exposure facing downside risks, such as additional capital expenditures and expenses. However, firms with exposure opportunities may enjoy upside potential benefits from innovation activities (e.g. renewable energy and energy storage) (Sautner *et al.*, 2023). Stern and Valero (2021) indicate that achieving the net zero transition requires significant investments in clean innovation, which is accompanied by investments in complementary assets, including sustainable infrastructure, and human, natural and social capital. According to an estimate from the World Economic Forum (2021), approximately \$50tn in incremental investments are needed in breakthrough technologies by 2050, such as solar technology, decarbonization, energy efficiency and carbon capture solutions, among others.

From the perspective of regulatory shocks related to climate change, achieving the Paris goals requires a series of intensified policies. For example, carbon pricing in the form of an emissions trading system (ETS) or carbon tax has been widely regarded as the most cost-effective and flexible method to achieve carbon emission reduction in line with the objectives of the Paris Agreement (The World Bank, 2022; UNCC, 2022). Studies in the literature have shown that carbon trading increases firm costs. For example, Goulder *et al.* (2010) document that a cap-and-trade system increases the marginal cost of production. Cohen *et al.* (2020) found that firms with high carbon footprints and higher regulatory risks create more and better green technologies than others. Shell plc (2022, p. 17) stated that “developing our low-carbon products and services is subject to challenges which could have a material adverse effect on our earnings, cash flows and financial condition.” Another study by Long *et al.* (2023) reveals that the implementation of ETS in China increases compliance costs and carbon risks, thereby motivating firms to engage in earnings management.

2.2 *Hypotheses development*

2.2.1 *Net zero targets and real earnings management.* While prior work on REM has largely examined financial reporting incentives in response to capital market pressures or regulatory oversight (Gunny, 2010; Roychowdhury, 2006; Zang, 2012) and sustainability research has focused on how CSR, ESG regulation or environmental policies influence disclosure quality, transparency and investment behavior (Christensen *et al.*, 2021; Grewal *et al.*, 2019), our study is the first to connect national net zero climate targets with firms' REM decisions [4]. In transitioning to the net zero targets, we conjecture that firms headquartered in countries that have committed to a net zero target are more likely to invest in new technologies and infrastructure systems in the coming years that could help firms to reduce the carbon emissions.

Firms are more likely to face increasing legitimacy and institutional threats and pressures if they are perceived as lagging in climate preparedness (see, e.g. Cho and Patten, 2007;

DiMaggio and Powell, 1983; Suchman, 1995; Patten, 2002). These threats and pressures could lead firms to commit to the net zero targets. The transition to the net zero targets may induce managers to act opportunistically to manage earnings using REM by reducing current capital expenditures and R&D that are less likely to have a direct effect on reducing carbon emissions in achieving the net zero targets, with the expectation that future investments under a net zero framework will be costlier for firms [5]. As a result, this REM strategy could enable firms to increase their current earnings and cash availability. The cash availability due to cash savings as a result of REM could be used to finance investments in new technologies and infrastructure systems in the coming years that allow firms to reduce their carbon emissions in the future. In this case, REM could be used by managers to prepare firms for moving toward the net zero targets while helping managers to record higher current earnings [6].

Collectively, based on the above discussions, we predict that firms are more likely to manage earnings through REM in transitioning to net zero targets. Hence, this study develops the following testable hypothesis:

- H1.* Firms headquartered in countries committed to a net zero target are more likely to engage in REM.

2.2.2 The role of CSR performance. Carroll (1979) conceptualized corporate social performance as encompassing economic, ethical, legal and discretionary aspects of business performance, forming the four basic expectations of CSR. Connelly *et al.* (2011) argued that managers can adopt sustainable practices to signal corporate trustworthiness and prospects to stakeholders. Margolis and Walsh (2003) proposed that firms considering the interests of all stakeholders are likely to engage in nonprofit maximizing CSR activities (Mackey *et al.*, 2007). Consistent with Carroll's (1979) model, firms that move CSR tend to reduce or avoid earnings management through discretionary accruals and real activities manipulations (Hong and Andersen, 2011; Kim *et al.*, 2012). Scholtens and Kang (2013) find a negative relationship between CSR and earnings management, measured by earnings smoothing and earnings aggressiveness, in an Asian context. These findings suggest that CSR-oriented firms meet ethical expectations and avoid opportunistic behavior by providing more transparent information and high-quality reporting.

However, some studies have documented a positive association between CSR and REM activities. For example, Kuo *et al.* (2021) suggested that CSR practices are positively associated with REM in firms where CEOs have higher shareholdings. A possible explanation for this finding is that higher shareholdings lead to stronger CEO alignment with the firm, incentivizing CEOs to engage in REM activities to enhance CSR performance and improve the firm's reputation. Kim *et al.* (2019) found that socially responsible firms with state control and in regions with higher institutional development engage more in REM activities due to increased legitimacy risk.

Given the significant funds required for operational transformations for moving toward the net zero targets, firms are motivated to manage real activities that directly impact cash flows to increase earnings, such as accelerating sales revenue and delaying R&D and capital outlays to reduce expenses. In addition, managers may need significant funds to enhance the firm's CSR performance, thereby inducing them to engage in more REM to report better earnings and cash flow (Boukattaya and Halaoua, 2022; Kim *et al.*, 2019; Kuo *et al.*, 2021). Consequently, it is plausible that firms with higher CSR performance are likely to engage in more REM for moving toward to the net zero transformation.

The discussion above suggests that higher CSR could either accelerate or mitigate the positive relationship between the commitment to the net zero targets and REM. Given the

inconclusive findings on the association between CSR performance and REM, we conjecture that CSR performance has no significant effect on the association between firms' REM and net zero targets. As such, we formulate the following nondirectional *H2*:

H2. The performance of CSR does not influence the relationship between firms' REM and net zero target commitment.

3. Research design

3.1 Data and research methodology

3.1.1 *Sample selection and description*. Panel A of [Table 1](#) presents the sample selection process by country, which begins with an initial sample of 195 countries sourced from Nationsline. Subsequently, we remove observations related to 33 countries with missing data in the WorldScope and Compustat Global database and 35 countries without information on net zero target commitment. In addition, we exclude the USA from the main sample in our analysis to avoid potential dominance of results, given its significant market size and number of observations in the global study. As a result, the selection process yields a final sample of 126 countries. After excluding all missing observations related to the measures of dependent and control variables, the main sample comprises 71 unique countries.

Panel B of [Table 1](#) details the firm-level sample selection process for the REM model and the related control variables. The initial sample consists of all publicly listed firms with available financial data in the WorldScope and Compustat Global Database from 2011 to 2021. Starting the study in 2011 allows for the exclusion of the impact of the global financial crisis. The initial sample comprises 650,748 firm-year observations. Among these, 368,575 observations are excluded due to missing data for the REM model and control variables. In addition, we exclude 32,462 observations related to firms in the financial sector. Consequently, the selection process results in a final sample of 249,711 firm-year observations for the test of *H1* and 28,685 firm-year observations for the test of *H2*, which examines the effect of CSR performance [7].

Panel C of [Table 1](#) displays the sample distribution by industry, country and year. The industry distribution is categorized based on the Fama-French 48 industries, with the top 10 industries being explicitly listed, and all other industries combined under the label "All others." Among the top 10 industries, 11.18% of the sample belongs to business services, 5.03% to machinery and 4.99% are chemical firms. In addition, 4.73% of the sample is composed of food product companies.

Regarding the country distribution, 16.49% of the sample firms are headquartered in China, while 14.04% and 13.26% of firm-year observations are from India and Japan, respectively. Firms from Australia account for 5.58% of the sample, and South Korea contributes 5.26% of the total sample. Panel C of [Table 1](#) also presents the yearly distribution of the sample, indicating the percentage of observations for each year from 2011 (7.99%) to 2021 (9.71%). This demonstrates the gradual increase in observations over the period of the study.

3.1.2 *Information on the net zero target by country*. The [Energy & Climate Intelligence Unit \(2022\)](#) provides data on the net zero target commitments for 126 countries. We manually collect the information on the net zero target commitment by each country from the websites of the Energy & Climate Intelligence Unit and Climate Home News. [Climate Home News \(2019b\)](#) offered the year of net zero target commitment for most countries in the sample, while for the remaining countries, the information is gathered through a manual search on their respective websites. The net zero target commitment varies in terms of the year of commitment and the level of commitment, which includes:

- in law;

Table 1. Sample selection, description and distribution

Descriptions	N		
<i>Panel A: Sample selection by country</i>			
Worldwide countries in Nationsline	195		
Less: countries not in WorldScope and Compustat Global databases	(33)		
Less: countries without information on net zero emission target commitment in Energy & Climate Intelligence Unit	(35)		
Less: USA	(1)		
<i>Total countries with information on net zero</i>	126		
<i>Total number of countries in the main sample</i>	71		
<i>Panel B: Sample selection by firm for real earnings management model</i>			
Firms covered in WorldScope and Compustat Global database from 2011 to 2021	650,748		
Less: firms with missing observations on data for real earnings management measures and related control variables	368,575		
Less: firms in the financial sector	32,462		
<i>Final sample for real earnings management model</i>	249,711		
<i>Panel C: Sample distribution by industry, country and year</i>			
<i>Industry distribution</i>			
No.	Industry name	Industry sample	Industry % of total
1	Business services	27,925	11.18
2	Machinery	12,558	5.03
3	Chemicals	12,456	4.99
4	Food products	11,821	4.73
5	Wholesale	11,353	4.55
6	Electronic equipment	10,646	4.26
7	Pharmaceutical products	10,584	4.24
8	Construction materials	9,924	3.97
9	Steel works	9,372	3.75
10	Retail	9,179	3.68
	All others	123,893	49.61
<i>Total</i>		249,711	100
<i>Country distribution</i>			
No.	Country name	Country sample	Country %
1	China	41,168	16.49
2	India	35,065	14.04
3	Japan	33,113	13.26
4	Australia	13,936	5.58
5	South Korea	13,882	5.56
6	UK	11,878	4.76
7	Malaysia	9,431	3.78
8	Sweden	6,345	2.54
9	Thailand	6,313	2.53
10	Singapore	6,101	2.44
	All others	72,479	29.03
<i>Total</i>		249,711	100
<i>Year distribution</i>			
No.	Year	Year sample	Year % of total
1	2011	19,940	7.99
2	2012	20,319	8.14
3	2013	21,760	8.71

(continued)

Table 1. Continued

No.	Year distribution		
	Year	Year sample	Year % of total
4	2014	22,184	8.88
5	2015	22,594	9.05
6	2016	23,021	9.22
7	2017	22,914	9.18
8	2018	23,823	9.54
9	2019	24,391	9.77
10	2020	24,506	9.81
11	2021	24,259	9.71
<i>Total</i>		249,711	100

Note(s): The table presents the sample selection by country and firm, and firm-year observations by industry, country and year. Panel A and Panel B report the sample selection of country level and firm level. Panel C reports the SIC 4-digit industry distribution, country distribution and yearly distribution of observations. The table presents the sample selection by country and firm, and firm-year observations by industry, country and year. Panel A and Panel B report the sample selection of country level and firm level. Panel C reports the SIC 4-digit industry distribution, country distribution and yearly distribution of observations

- in official policy document;
- in declaration/pledge; and
- in discussion/proposed.

3.2 Empirical models

To test whether firms headquartered in countries committed to the net zero targets are more likely to engage in REM activities, we estimate the following regression model for *H1*:

$$\begin{aligned}
 REM_{i,t} = & \beta_0 + \beta_1 COUNTRY_NETZERO_{i,t} + \beta_2 CLIMATE_RISK_{i,t} + \beta_3 CO2_PER_CAPITA_{i,t} \\
 & + \beta_4 GDP_PER_CAPITA_{i,t} + \beta_5 GDP_GROWTH_RATE_{i,t} + \beta_6 CORRUPT_CONTROL_{i,t} \\
 & + \beta_7 GOV_EFFECT_{i,t} + \beta_8 POL_STABILITY_{i,t} + \beta_9 REGULATE_QUAL_{i,t} \\
 & + \beta_{10} RULE_LAW_{i,t} + \beta_{11} VOICE_ACCOUNT_{i,t} + \beta_{12} CTR_{i,t} + \beta_{13} SIZE_{i,t} + \beta_{14} LEV_{i,t} \\
 & + \beta_{15} ROA_{i,t} + \beta_{16} CASH_{i,t} + \beta_{17} PPE_{i,t} + \beta_{18} INTANG_{i,t} + \beta_{19} FOREIGN_{i,t} + \beta_{20} R\&D_{i,t} \\
 & + \beta_{21} SGA_{i,t} + \beta_{22} CAPEX_{i,t} + \beta_{23} COVID19_{i,t} + INDUSTRY_{j,t} \\
 & + COUNTRY_{c,t} + YEAR_t + e_{i,t}
 \end{aligned}
 \tag{1}$$

where the subscripts *i*, *j*, *c* and *t* denote firm, industry, country and year, respectively. The regression model includes industry, country and year fixed effects, and uses appropriate indicator variables (*INDUSTRY*, *COUNTRY* and *YEAR*). We cluster the standard errors at the firm level. To test the impact of the net zero target commitment of a country on *REM*, this study uses a variable of interest, *COUNTRY_NETZERO*, a categorical variable coded 1 if the country where the firm is headquartered committed to a net zero target in that fiscal year, and 0 otherwise.

Next, we introduce an interaction variable of *COUNTRY_NETZERO*CSR_{i,t}* in the model to examine the incremental effect of a firm's *CSR* performance on the relation between *COUNTRY_NETZERO_{i,t}* and *REM*. The following regression model is estimated to test *H2*:

$$\begin{aligned}
 REM_{i,t} = & \beta_0 + \beta_1 COUNTRY_NETZERO_{i,t} + \beta_2 CSR_{i,t} + \beta_3 COUNTRY_NETZERO * CSR_{i,t} \\
 & + \beta_4 CLIMATE_RISK_{i,t} + \beta_5 CO2_PER_CAPITA_{i,t} + \beta_6 GDP_PER_CAPITA_{i,t} \\
 & + \beta_7 GDP_GROWTH_RATE_{i,t} + \beta_8 CORRUPT_CONTROL_{i,t} + \beta_9 GOV_EFFECT_{i,t} \\
 & + \beta_{10} POL_STABILITY_{i,t} + \beta_{11} REGULATE_QUAL_{i,t} + \beta_{12} RULE_LAW_{i,t} \\
 & + \beta_{13} VOICE_ACCOUNT_{i,t} + \beta_{14} CTR_{i,t} + \beta_{15} SIZE_{i,t} + \beta_{16} LEV_{i,t} + \beta_{17} ROA_{i,t} + \beta_{18} CASH_{i,t} \\
 & + \beta_{19} PPE_{i,t} + \beta_{20} INTANG_{i,t} + \beta_{21} FOREIGN_{i,t} + \beta_{22} R\&D_{i,t} + \beta_{23} SGA_{i,t} + \beta_{24} CAPEX_{i,t} \\
 & + \beta_{25} COVID19_{i,t} + INDUSTRY_{j,t} + COUNTRY_{c,t} + YEAR_t + e_{i,t}
 \end{aligned}
 \tag{2}$$

CSR score is available in the Refinitiv database and comprises individual components related to environmental, social and corporate governance performance, and the overall CSR score. The variable of interest used is the interaction of country-level net zero target commitment and CSR performance ($COUNTRY_NETZERO * CSR$), to test for the incremental effect of CSR on the relation between country-level net zero target commitment and REM.

Because a country's net zero target commitment is a regulatory shock for firms headquartered in that country, the setting of this study is less likely to be affected by endogeneity concerns. However, firms can voluntarily commit to the net zero targets. To address this concern, several additional tests are conducted, which include PSM and analysis based on firms' commitment to the net zero targets.

3.3 Dependent variables

We use four measures of REM following prior literature (e.g. [Achleitner et al., 2014](#); [Cohen and Zarowin, 2010](#); [Garg, 2018](#); [Ghaleb et al., 2020](#); [Paredes and Wheatley, 2017](#); [Roychowdhury, 2006](#)). These four measures include abnormal cash flow from operations (REM_CFO), abnormal discretionary expenses (REM_DISEXP), abnormal production costs ($REM_PRODCOST$) and the sum of the three aforementioned measures (REM_SUM).

The first measure of REM is abnormal operating cash flow. To estimate this measure, the following cross-sectional regression (3) for each industry (based on Fama-French 48 industries) and year to capture the normal level of operating cash flows is used. The abnormal cash flow from operations for year t (REM_CFO_t) is the residual from regression (3):

$$\frac{CFO_t}{TA_{t-1}} = \alpha_0 + \alpha_1 \left(\frac{1}{TA_{t-1}} \right) + \beta_1 \left(\frac{S_t}{TA_{t-1}} \right) + \beta_2 \left(\frac{\Delta S_t}{TA_{t-1}} \right) + \varepsilon_t
 \tag{3}$$

where CFO_t is the cash flow from operations at the end of period t ;

TA_t is the total assets at the end of period t ; S_t is the sales during period t ; and $\Delta S_t = S_t - S_{t-1}$

The second measure of REM is abnormal discretionary expenses. We run cross-sectional regression (4) for each industry (based on Fama-French 48 industries) and year. The abnormal discretionary expenses for year t (REM_DISEXP_t) are the residuals from regression (4):

$$\frac{DISEXP_t}{TA_{t-1}} = \alpha_0 + \alpha_1 \left(\frac{1}{TA_{t-1}} \right) + \beta \left(\frac{S_{t-1}}{TA_{t-1}} \right) + \varepsilon_t \quad (4)$$

where $DISEXP_t$ is the sum of R&D expenses, advertising expenses, and SG&A expenses at the end of period t ; and. Other variables are as defined in Supplementary Material A.

To obtain the third measure of REM abnormal production costs, we run regression (5) for each industry (based on Fama-French 48 industries) and year, to obtain the normal production costs. The abnormal production costs ($REM_PRODCOST_t$) are the residuals from regression (5):

$$\frac{PROD_t}{TA_{t-1}} = \alpha_0 + \alpha_1 \left(\frac{1}{TA_{t-1}} \right) + \beta_1 \left(\frac{S_t}{TA_{t-1}} \right) + \beta_2 \left(\frac{\Delta S_t}{TA_{t-1}} \right) + \beta_3 \left(\frac{\Delta S_{t-1}}{TA_{t-1}} \right) + \varepsilon_t \quad (5)$$

where $PROD_t$ is the sum of the cost of goods sold and the change in inventories at the end of period t . Other variables are as defined in Supplementary Material A.

Finally, we use the sum of the three proxies of REM above (REM_SUM) as the fourth measure. Considering the advantages and disadvantages of the REM measures, we test $H1$ and $H2$ using each of the four measures of REM as the variable of interest in separate regression models.

3.4 Independent variables of interest

Our main independent variable of interest is $COUNTRY_NETZERO$, which represents the net zero target commitment at the country level. This variable is coded one if a country has committed to net zero targets either in law, or in an official policy document, or is in declaration/pledge, or proposed/in discussion, and zero otherwise.

In addition, we measure the intensity of the net zero target commitment based on the level of commitment. Our main underlying assumption is that the intensity of the regulatory change related to the net zero target commitment is higher for countries that have enacted the net zero targets in law compared to those in declaration/pledge. To operationalize this concept, we first code the four commitment levels as 4 (in law), 3 (policy document), 2 (declaration/pledge) and 1 (proposed/in discussion). Supplementary Material B provides a detailed explanation of the coding of the intensity variable. Next, we use the square of these scores (i.e. 16, 9, 4, 1 for in law, policy document, declaration/pledge and proposed/in discussion, respectively) of commitment as a proxy for the intensity of net zero target commitment on the firm ($INTENSITY_NETZERO_SQUARE$) [8].

3.5 Control variables

3.5.1 Country-level control variables. The country-level financial control variables include GDP_GROWTH and GDP_PER_CAPITA to control the level of economic development. In addition, we include country-level corporate tax rate (CTR) to control for corporate tax rate legislated in each of the countries, as a higher (lower) statutory corporate tax rate is projected to have more (less) negative impact on the cash flows for firms headquartered in countries that commit to the net zero targets. Following Montenegro (2021), we include a number of national governance indicators such as corruption control ($CORRUPT_CONTROL$), government effectiveness (GOV_EFFECT), political stability and absence of violence/terrorism ($POL_STABILITY$), regulatory quality ($REGULATE_QUAL$), rule of law ($RULE_LAW$) and voice and accountability ($VOICE_ACCOUNT$). The models also control for climate risk ($CLIMATE_RISK$) and CO₂ emission per capita ($CO2_PER_CAPITA$). To control for the effect of

COVID-19, we use a categorical variable *COVID19*, coded 1 if the financial year of observation is 2020 or 2021, and 0 otherwise. All variables are defined in Supplementary Material A.

3.5.2 *Firm-level control variables.* We control the regression model with firm-level variables. Following Achleitner et al. (2014) and Ahmed et al. (2022), we include the log of total assets (*SIZE*), leverage (*LEV*) and return on assets (*ROA*) as control variables. We also include other control variables that may affect the association between the independent variables of interest and the dependent variables such as cash and cash equivalents (*CASH*), intangible assets (*INTANG*), whether a firm has foreign exchange transactions (*FOREIGN*), property, plant and equipment (*PPE*), research and development expense (*R&D*), selling, general and administrative expenses (*SGA*), and capital expenditures (*CAPEX*). We define all these variables in Supplementary Material A.

4. Empirical results

4.1 Descriptive statistics

Table 2 presents the descriptive statistics for the REM model based on the full sample. The mean value for country-level target commitment (*COUNTRY_NETZERO*) is 0.15, suggesting that 15% of observations in the sample are headquartered in a country that committed to a net zero target. The mean (median) value for *REM_CFO* is 0.142 (0.077), for *REM_DISEXP* is 0.146 (0.080) and for *REM_PRODCOST* is 0.138 (0.089). Furthermore, the mean (median) value of *REM_SUM*, the sum of three individual measures of REM, is 0.427 (0.299) [9].

4.2 Correlation analyses

Table 3 presents the Pearson correlation matrix based on the REM model. *COUNTRY_NETZERO* is significantly positively correlated with *REM_DISEXP* (coefficient = 0.06, p -value < 0.001), *REM_PRODCOST* (coefficient = 0.02, p -value < 0.001) and *REM_SUM* (coefficient = 0.02, p -value < 0.001).

4.3 Effect of the net zero target commitment on REM

Table 4 reports the regression results on the relation between net zero target commitment and REM. The results show that *COUNTRY_NETZERO* is positively associated with all four measures of REM and is statistically significant at the 1% level (*REM_CFO*: coefficient = 0.014, p -value < 0.01; *REM_DISEXP*: coefficient = 0.011, p -value < 0.01; *REM_PRODCOST*: coefficient = 0.007, p -value < 0.01; *REM_SUM*: coefficient = 0.032, p -value < 0.01) [10]. Collectively, the results provide support for *H1* that firms headquartered in countries with the net zero target commitment have a higher likelihood of managing earnings through real activities [11]. The findings suggest that in transitioning toward the net zero targets, firms' managers record higher earnings via REM by reducing current capital expenditures and/or R&D, which has less impact on reducing carbon emissions. This REM strategy has provided potential for higher cash availability in preparing firms to invest in new technologies and infrastructure systems in the coming years, which would help firms to reduce carbon emissions in the future in meeting the net zero targets.

In relation to the control variables, the results indicate that larger firms (*SIZE*) and firms with more property, plant and equipment (*PPE*) and intangible assets (*INTANG*) have a lower possibility of engaging in REM. In addition, firms with higher leverage (*LEV*), cash (*CASH*), research and development expenses (*R&D*) and capital expenditures (*CAPEX*) exhibit more REM [12].

Table 2. Descriptive statistics

Variable	N	Mean	Median	Q1	Q3	SD
REM_CFO	249,711	0.142	0.077	0.033	0.157	0.228
REM_DISEXP	249,711	0.146	0.080	0.030	0.185	0.188
REM_PRODCOST	249,711	0.138	0.089	0.035	0.187	0.149
REM_SUM	249,711	0.427	0.299	0.163	0.544	0.402
DISACC	249,711	0.008	0.006	-0.039	0.050	0.103
COUNTRY_NETZERO	249,711	0.150	0.000	0.000	0.000	0.357
R&D	249,711	0.021	0.000	0.000	0.011	0.068
SGA	249,711	0.333	0.145	0.071	0.267	1.037
CAPEX	249,711	0.094	0.019	0.002	0.192	0.125
CASH	249,711	0.166	0.113	0.042	0.232	0.169
FOREIGN	249,711	0.225	0.000	0.000	0.000	0.418
INTANG	249,711	0.079	0.014	0.001	0.076	0.145
LEV	249,711	0.521	0.030	0.000	0.662	0.834
SIZE	249,711	7.858	7.728	5.668	9.965	3.145
PPE	249,711	0.523	0.447	0.171	0.790	0.427
ROA	249,711	0.018	0.039	0.000	0.086	0.167
CORRUPT_CONTROL	249,711	0.550	0.183	-0.295	1.561	0.996
GOV_EFFECT	249,711	0.834	0.768	0.171	1.572	0.759
POL_STABILITY	249,711	0.032	0.101	-0.613	0.889	0.858
REGULATE_QUAL	249,711	0.617	0.637	-0.227	1.354	0.858
RULE_LAW	249,711	0.629	0.465	-0.091	1.525	0.883
VOICE_ACCOUNT	249,711	0.215	0.441	-0.512	1.057	1.066
GDP_GROWTH_RATE	249,711	3.530	3.202	1.621	6.454	3.672
GDP_PER_CAPITA	249,711	9.518	9.438	8.742	10.619	1.251
CTR	249,711	0.273	0.275	0.242	0.300	0.058
COVID19	249,711	0.182	0.000	0.000	0.000	0.386
CLIMATE_RISK	249,711	49.678	43.330	25.330	66.000	28.325
CO2_PER_CAPITA	249,711	6.938	7.124	3.826	9.162	4.254
CSR	28,685	0.550	0.616	0.249	0.830	0.306

Note(s): All continuous variables are winsorized at the 1st and 99th percentiles. Refer to Supplementary A for variable definitions

4.4 Effect of CSR on the relation between the net zero target commitment and REM

Table 5 presents the regression results of H2, which examines the effect of a firm's CSR on the interaction between the net zero target commitment and REM activities. The coefficient estimates on the interaction between country-level net zero target commitment and CSR (*COUNTRY_NETZERO*CSR*) are negative and statistically significant for three of the four measures of REM (*REM_CFO*: coefficient = -0.034, p -value < 0.01; *REM_DISEXP*: coefficient = -0.032, p -value < 0.01; *REM_SUM*: coefficient = -0.071, p -value < 0.01).

The findings from this analysis suggest that the CSR performance of firms plays a significant role in mitigating the positive association between the net zero target commitment and REM activities. In other words, firms with higher CSR performance are better equipped to handle the regulatory shock of net zero targets in their home country, leading to a reduced likelihood of engaging in REM practices.

The comprehensive CSR score comprises three key components of performance: environmental, social and corporate governance. Each of these measures, both individually and collectively, contributes to the firm's readiness and willingness to align with the objectives associated with the net zero target commitment. By demonstrating a commitment

Table 3. Correlation matrix

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1 COUNTRY_NEUTZERO	N/A																											
2 REM_CFO	-0.03	N/A																										
3 REM_DISEXP	0.06	0.20	N/A																									
4 REM_PRODOST	0.02	0.16	0.44	N/A																								
5 REM_SUM	0.02	0.71	0.74	0.67	N/A																							
6 DISACC	-0.04	0.04	-0.06	-0.01	-0.01	N/A																						
7 CLIMATE_RISK	0.09	0.02	0.09	0.03	0.07	-0.06	N/A																					
8 GDP_PER_CAPITA	0.12	-0.01	0.28	0.07	0.15	-0.07	0.45	N/A																				
9 GDP_GROWTH_RATE	-0.06	0.02	-0.14	-0.05	-0.07	0.07	-0.14	-0.43	N/A																			
10 CO2_PER_CAPITA	-0.04	-0.02	0.14	-0.01	0.05	-0.02	0.21	0.70	-0.21	N/A																		
11 CORRUPT_CONTROL	0.09	0.02	0.32	0.11	0.20	-0.08	0.35	0.88	-0.42	0.53	N/A																	
12 GOV_EFFECT	0.11	0.00	0.28	0.09	0.16	-0.07	0.37	0.89	-0.39	0.59	0.95	N/A																
13 POL_STABILITY	0.09	-0.01	0.25	0.08	0.14	-0.06	0.34	0.86	-0.40	0.59	0.87	0.88	N/A															
14 REGULATE_QUAL	0.08	0.02	0.30	0.10	0.19	-0.08	0.44	0.90	-0.45	0.58	0.95	0.94	0.85	N/A														
15 RULE_LAW	0.08	0.02	0.31	0.11	0.19	-0.09	0.36	0.85	-0.45	0.53	0.97	0.95	0.85	0.96	N/A													
16 VOICE_ACCOUNT	-0.01	0.04	0.26	0.13	0.20	-0.11	0.19	0.52	-0.47	0.20	0.73	0.62	0.56	0.73	0.79	N/A												
17 CTR	-0.16	0.01	0.01	0.03	0.02	-0.02	-0.49	-0.16	-0.04	-0.09	0.00	-0.06	-0.08	-0.13	0.02	0.30	N/A											
18 SIZE	-0.01	-0.10	-0.25	-0.09	-0.21	0.01	-0.18	-0.14	0.01	-0.05	-0.21	-0.13	-0.04	-0.23	-0.18	-0.15	0.14	N/A										
19 LEV	-0.03	-0.03	-0.09	-0.04	-0.08	-0.04	-0.13	-0.10	-0.07	-0.05	-0.06	-0.04	-0.01	-0.07	-0.01	0.11	0.19	0.54	N/A									
20 ROA	-0.05	-0.08	-0.21	0.12	-0.10	0.32	-0.08	-0.15	0.10	-0.13	-0.18	-0.15	-0.12	-0.19	-0.18	0.02	0.29	0.04	N/A									
21 CASH	0.09	0.09	0.25	0.09	0.21	0.03	0.02	0.21	-0.03	0.19	0.16	0.20	0.19	0.15	0.14	-0.03	-0.04	-0.11	-0.19	-0.05	N/A							
22 PPE	-0.08	-0.06	-0.15	-0.09	-0.14	-0.09	-0.01	-0.03	-0.07	0.00	-0.02	-0.04	0.00	-0.01	-0.01	0.04	0.03	0.15	0.20	0.01	-0.30	N/A						
23 INTANG	0.07	-0.01	0.12	0.07	0.08	-0.10	0.15	0.25	-0.12	0.06	0.26	0.21	0.18	0.25	0.24	0.21	-0.08	-0.15	-0.13	-0.05	-0.10	-0.26	N/A					
24 FOREIGN	0.00	-0.02	-0.02	-0.03	0.01	-0.02	0.02	0.03	0.05	-0.03	0.02	0.01	-0.03	-0.02	-0.06	0.00	0.17	0.09	0.07	0.04	-0.01	-0.01	N/A					
25 R&D	0.10	0.06	0.34	0.02	0.20	-0.06	0.07	0.16	-0.04	0.08	0.14	0.15	0.11	0.13	0.05	-0.03	-0.11	-0.09	-0.22	0.25	-0.15	0.12	0.05	N/A				
26 SGA	0.03	0.04	0.37	-0.03	0.18	-0.02	0.04	0.13	-0.06	0.13	0.15	0.12	0.11	0.16	0.15	0.13	-0.01	-0.19	-0.08	-0.28	0.12	-0.05	0.03	-0.04	0.28	N/A		
27 CAPEX	-0.06	-0.02	-0.07	-0.01	-0.04	0.00	-0.19	-0.16	-0.05	-0.06	-0.12	-0.09	-0.04	-0.13	-0.06	0.06	0.21	0.62	0.64	0.13	-0.09	0.23	-0.21	0.15	-0.08	-0.09	N/A	
28 COVID19	0.76	-0.05	-0.01	-0.01	-0.03	-0.02	-0.04	0.04	-0.29	-0.04	0.01	0.05	0.04	0.01	0.01	-0.05	-0.12	0.04	0.02	-0.02	0.08	-0.03	0.00	-0.01	0.05	0.01	0.00	N/A
29 CSR	-0.03	-0.04	-0.06	-0.01	-0.05	-0.04	0.05	0.04	-0.11	-0.15	0.08	0.07	0.03	0.10	0.11	0.19	-0.02	0.18	0.01	0.13	-0.24	0.12	0.10	-0.04	-0.11	-0.14	-0.01	-0.04

Note(s): The table presents the correlation matrix. Pearson (Spearman) correlations are presented in the lower (upper) diagonal. Correlations significant at the two-tailed 0.05 level or less are in bold figures. All continuous variables are winsorized at the 1st and 99th percentiles. Refer to Supplementary A for variable definitions

Table 4. Effect of country net zero target commitment on real earnings management (H1)

Dependent variable	REM_CFO	REM_DISEXP	REM_PRODCOST	REM_SUM
CONSTANT	0.503*** (12.30)	0.199*** (7.94)	0.135*** (5.27)	0.831*** (12.71)
COUNTRY_NETZERO	0.014*** (5.77)	0.011*** (5.41)	0.007*** (4.17)	0.032*** (7.68)
CLIMATE_RISK	0.000 (0.74)	-0.000 (-0.40)	-0.000*** (-4.58)	-0.000 (-1.30)
GDP_PER_CAPITA	-0.026*** (-4.96)	0.005* (1.65)	0.006* (1.83)	-0.014* (-1.76)
GDP_GROWTH_RATE	0.000* (1.93)	-0.000* (-1.79)	0.000** (2.12)	0.000 (1.21)
CO2_PER_CAPITA	-0.009*** (-8.68)	-0.002*** (-3.92)	0.002*** (2.97)	-0.010*** (-6.34)
CORRUPT_CONTROL	-0.021*** (-3.61)	-0.007* (-1.87)	0.016*** (4.29)	-0.013 (-1.42)
GOV_EFFECT	0.009* (1.91)	0.001 (0.39)	0.010*** (3.15)	0.021*** (2.73)
POL_STABILITY	-0.026*** (-6.87)	-0.010*** (-4.44)	0.008*** (3.33)	-0.027*** (-4.71)
REGULATE_QUAL	0.001 (0.16)	-0.007* (-1.83)	0.017*** (4.67)	0.009 (0.93)
RULE_LAW	0.001 (0.20)	-0.005 (-1.13)	-0.040*** (-9.59)	-0.046*** (-4.28)
VOICE_ACCOUNT	0.008 (1.45)	0.012*** (3.52)	-0.010*** (-2.67)	0.011 (1.19)
CTR	0.042 (1.47)	-0.035 (-1.64)	0.077*** (3.95)	0.079 (1.57)
SIZE	-0.008*** (-26.15)	-0.016*** (-37.75)	-0.008*** (-21.40)	-0.032*** (-37.08)
LEV	0.002* (1.90)	0.003*** (2.75)	-0.001 (-0.98)	0.003* (1.65)
ROA	-0.067*** (-11.65)	-0.022*** (-4.09)	0.143*** (30.53)	0.052*** (4.35)
CASH	0.115*** (26.46)	0.113*** (21.95)	0.063*** (14.41)	0.292*** (27.18)
PPE	-0.015*** (-9.22)	-0.013*** (-7.00)	-0.009*** (-5.01)	-0.037*** (-9.16)
INTANG	-0.030*** (-6.52)	0.010 (1.43)	-0.006 (-1.13)	-0.027** (-2.03)
FOREIGN	0.002 (1.40)	0.002** (2.31)	-0.002* (-1.93)	0.002 (0.91)
R&D	0.039*** (3.60)	0.346*** (18.65)	-0.018* (-1.72)	0.372*** (11.79)
SGA	-0.003*** (-4.94)	0.041*** (32.97)	-0.005*** (-9.61)	0.035*** (19.65)
CAPEX	0.097*** (13.72)	0.162*** (21.19)	0.115*** (15.91)	0.373*** (22.51)
COVID19	-0.086*** (-20.11)	-0.008*** (-3.05)	-0.010*** (-4.08)	-0.104*** (-15.65)
Industry fixed effect	Yes	Yes	Yes	Yes
Country fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
N	249,711	249,711	249,711	249,711
Adjusted R-squared	0.086	0.392	0.121	0.224

Note(s): *, ** and *** denote significant level at the 0.1, 0.05 and 0.01 levels, respectively, using two-tailed, *p*-values

to sustainability and responsible business practices, these socially responsible firms are better prepared to face the challenges posed by the net zero target commitment and are less inclined to resort to REM as a coping mechanism [13].

Overall, our results are consistent with the theoretical framework developed by Carroll (1979), which posits that firms address their obligations to society through economic, legal, ethical and discretionary performance. In particular, our findings provide support to prior literature in showing that CSR-oriented firms appear to reduce or avoid earnings management through real activities manipulations.

5. Robustness checks and additional analyses

5.1 Propensity score matching

To address endogeneity concerns, we use the PSM methodology. In the PSM approach, each observation in the subsample from countries with the net zero targets is matched with an observation from countries without the net zero targets, based on their closest propensity score within a caliper of 0.10, considering all control variables. The matched observations from both subsamples are then pooled to create the matched sample.

Table 5. Effect of CSR performance on the relationship between country net zero target commitment and real earnings management (*H2*)

Dependent variable	<i>REM_CFO</i>	<i>REM_DISEXP</i>	<i>REM_PRODCOST</i>	<i>REM_SUM</i>
CONSTANT	0.346** (2.42)	0.469*** (4.54)	0.265** (2.45)	1.079*** (3.65)
<i>COUNTRY_NETZERO</i>	0.028*** (4.56)	0.023*** (3.40)	0.011* (1.74)	0.063*** (4.31)
<i>CSR</i>	0.015*** (2.65)	0.037*** (5.18)	0.019** (2.57)	0.071*** (4.51)
<i>COUNTRY_NETZERO*CSR</i>	-0.034*** (-4.34)	-0.032*** (-3.47)	-0.004 (-0.50)	-0.071*** (-3.64)
<i>CLIMATE_RISK</i>	0.000*** (2.64)	0.000** (2.09)	0.000 (0.56)	0.000*** (2.79)
<i>GDP_PER_CAPITA</i>	-0.022 (-1.30)	-0.024*** (-2.80)	0.007 (0.74)	-0.039 (-1.51)
<i>GDP_GROWTH_RATE</i>	-0.000 (-0.25)	0.001** (2.24)	0.000 (0.94)	0.001 (0.93)
<i>CO2_PER_CAPITA</i>	-0.002 (-0.65)	0.000 (0.05)	0.004** (2.27)	0.002 (0.55)
<i>CORRUPT_CONTROL</i>	-0.013 (-0.97)	-0.010 (-1.13)	0.000 (0.01)	-0.023 (-1.05)
<i>GOV_EFFECT</i>	0.003 (0.22)	0.002 (0.24)	-0.003 (-0.32)	0.002 (0.12)
<i>POL_STABILITY</i>	-0.016 (-1.53)	-0.002 (-0.41)	0.002 (0.37)	-0.016 (-1.01)
<i>REGULATE_QUAL</i>	0.019 (1.16)	0.022** (2.51)	0.018** (1.98)	0.059** (2.43)
<i>RULE_LAW</i>	-0.034 (-1.50)	-0.025** (-2.21)	-0.024* (-1.90)	-0.084** (-2.54)
<i>VOICE_ACCOUNT</i>	-0.031 (-1.50)	0.002 (0.16)	-0.005 (-0.39)	-0.034 (-1.13)
<i>CTR</i>	-0.007 (-0.11)	0.046 (0.96)	-0.018 (-0.38)	0.021 (0.18)
<i>SIZE</i>	-0.009*** (-8.93)	-0.021*** (-14.07)	-0.016*** (-10.52)	-0.045*** (-14.05)
<i>LEV</i>	0.005** (2.08)	-0.001 (-0.32)	-0.003 (-1.10)	0.001 (0.11)
<i>ROA</i>	0.124*** (6.46)	0.089*** (4.64)	0.294*** (15.49)	0.506*** (10.54)
<i>CASH</i>	0.161*** (12.13)	0.059*** (3.35)	0.062*** (3.91)	0.284*** (7.48)
<i>PPE</i>	0.016*** (4.10)	0.001 (0.21)	0.012** (2.13)	0.028** (2.45)
<i>INTANG</i>	0.014 (1.57)	0.000 (0.02)	0.009 (0.70)	0.023 (0.80)
<i>FOREIGN</i>	-0.002 (-0.77)	-0.004* (-1.83)	-0.005** (-2.17)	-0.011** (-2.10)
<i>R&D</i>	0.102*** (3.73)	0.352*** (6.96)	0.032 (0.90)	0.485*** (5.06)
<i>SGA</i>	0.005** (2.04)	0.027*** (6.36)	0.004 (1.63)	0.036*** (4.39)
<i>CAPEX</i>	0.091*** (3.35)	0.051 (1.59)	0.026 (0.83)	0.168** (2.41)
<i>COVID19</i>	-0.087*** (-8.35)	-0.005 (-0.96)	-0.025*** (-3.88)	-0.117*** (-7.43)
Industry fixed effect	Yes	Yes	Yes	Yes
Country fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
<i>N</i>	28,685	28,685	28,685	28,685
Adjusted <i>R</i> -squared	0.087	0.387	0.227	0.269

Note(s): *, ** and *** denote significant level at the 0.1, 0.05 and 0.01 levels, respectively, using two-tailed *p*-values

Table 6 presents the regression results for the matched sample, using the same dependent and independent variables as in the main model. The findings from the PSM sample, which includes 65,037 observations, are consistent with the main results. Specifically, *COUNTRY_NETZERO* is positively associated with all four measures of *REM* and is statistically significant when *REM_CFO* is used as the dependent variable (coefficient = 0.031). Similarly, for *REM_DISEXP*, *REM_PRODCOST* and *REM_SUM*, the coefficients are 0.022, 0.017 and 0.074, respectively and are statistically significant at the 1% level. Overall, the results from the PSM analysis provide further support to the main findings, reinforcing the positive association between the commitment to the net zero targets by countries and firms' engagement in REM activities.

5.2 Intensity of the net zero target commitment

Table 7 presents the results of the analysis using the intensity of country-level net zero targets, which captures not only whether a country has committed to a target but also the strength of its commitment (law, policy, pledge or proposal). This allows us to empirically differentiate between “symbolic” commitment and “substantive” commitment, providing

Table 6. A propensity score matching analysis

Dependent variable	REM_CFO	REM_DISEXP	REM_PROD COST	REM_SUM
CONSTANT	0.544*** (4.63)	0.395*** (3.58)	0.191* (1.92)	1.112*** (4.62)
COUNTRY_NETZERO	0.031*** (4.13)	0.022*** (3.56)	0.017*** (3.76)	0.074*** (5.71)
CLIMATE_RISK	-0.000 (-0.14)	0.000 (1.13)	-0.000 (-0.83)	0.000 (0.19)
GDP_PER_CAPITA	-0.021 (-1.43)	0.004 (0.37)	-0.001 (-0.11)	-0.015 (-0.60)
GDP_GROWTH_RATE	0.000 (0.79)	-0.001*** (-2.96)	-0.001** (-2.16)	-0.002* (-1.84)
CO2_PER_CAPITA	-0.007*** (-3.55)	-0.002* (-1.90)	0.003*** (3.10)	-0.006** (-2.24)
CORRUPT_CONTROL	-0.035*** (-3.33)	-0.001 (-0.07)	0.022*** (2.97)	-0.016 (-0.83)
GOV_EFFECT	0.012 (1.08)	0.010 (1.11)	0.013 (1.56)	0.037* (1.85)
POL_STABILITY	-0.039*** (-5.12)	-0.005 (-0.83)	0.011** (1.96)	-0.031** (-2.30)
REGULATE_QUAL	0.011 (0.82)	-0.016 (-1.62)	-0.012 (-1.40)	-0.021 (-0.98)
RULE_LAW	-0.005 (-0.30)	-0.042*** (-2.98)	-0.038*** (-3.12)	-0.094*** (-3.04)
VOICE_ACCOUNT	0.030** (2.13)	0.016* (1.92)	-0.008 (-0.99)	0.041* (1.87)
CTR	-0.119* (-1.74)	-0.077 (-1.37)	0.121** (2.55)	-0.081 (-0.66)
SIZE	-0.014*** (-12.56)	-0.036*** (-22.26)	-0.006*** (-4.37)	-0.056*** (-18.61)
LEV	-0.005 (-1.15)	0.005 (1.21)	0.001 (0.22)	0.002 (0.17)
ROA	-0.127*** (-17.09)	-0.054*** (-6.71)	0.086*** (12.69)	-0.099*** (-5.99)
CASH	0.118*** (16.92)	0.097*** (10.30)	0.046*** (6.26)	0.265*** (14.17)
PPE	-0.016*** (-5.39)	0.010*** (2.97)	0.012*** (3.68)	0.006 (0.79)
INTANG	-0.044*** (-6.12)	-0.023** (-1.99)	-0.029*** (-3.42)	-0.097*** (-4.57)
FOREIGN	0.007** (2.39)	0.008** (2.52)	0.001 (0.48)	0.016** (2.50)
R&D	0.026* (1.92)	0.294*** (13.01)	-0.007 (-0.56)	0.315*** (8.22)
SGA	-0.003*** (-4.15)	0.042*** (33.05)	-0.007*** (-13.39)	0.034*** (18.79)
CAPEX	0.208*** (6.71)	0.262*** (9.67)	0.239*** (8.80)	0.703*** (11.01)
COVID19	-0.070*** (-7.17)	-0.012 (-1.44)	-0.011* (-1.79)	-0.095*** (-5.53)
Industry fixed effect	Yes	Yes	Yes	Yes
Country fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
N	65,037	65,037	65,037	65,037
Adjusted R-squared	0.111	0.427	0.139	0.268

Note(s): *, ** and *** denote significant level at the 0.1, 0.05 and 0.01 levels, respectively, using two-tailed *p*-values

richer evidence than a binary treatment indicator often used in the literature. The findings indicate that firms headquartered in countries with higher commitment levels to a net zero target are more likely to engage in REM activities. These results are consistent across all four measures of REM (*REM_CFO*: coefficient = 0.001, *p*-value < 0.01; *REM_DISEXP*: coefficient = 0.001, *p*-value < 0.01; *REM_PROD COST*: coefficient = 0.001, *p*-value < 0.01; *REM_SUM*: coefficient = 0.002, *p*-value < 0.01).

Overall, the results suggest that as the intensity of the net zero target commitment increases, firms in those countries are more inclined to use REM as a strategy, possibly to cope with the financial burden of operational transformation required to achieve the net zero targets.

5.3 Separate analysis of components of CSR performance

The various dimensions of CSR are expected to have different interactions with earnings management activities. Prior literature (e.g. [Bozzolan et al., 2015](#); [Martinez-Ferrero et al., 2016](#)) discusses the use of an overall CSR score on earnings management. To further investigate the impact of CSR performance on REM activities, we follow the approach of previous studies ([Chollet and Sandwidi, 2018](#); [Shakil et al., 2019](#)) and separately examine three measures of CSR: environment, social responsibility and corporate governance.

Table 7. Intensity of the net zero target commitment

Dependent variable	REM_CFO	REM_DISEXP	REM_PRODCOST	REM_SUM
CONSTANT	0.500*** (12.23)	0.195*** (7.78)	0.132*** (5.15)	0.822*** (12.55)
INTENSITY_NETZERO_SQUARE	0.001*** (4.75)	0.001*** (4.90)	0.001*** (3.93)	0.002*** (6.65)
CLIMATE_RISK	0.000 (1.08)	-0.000 (-0.05)	-0.000*** (-4.35)	-0.000 (-0.85)
GDP_PER_CAPITA	-0.026*** (-5.01)	0.005* (1.65)	0.006* (1.83)	-0.014* (-1.79)
GDP_GROWTH_RATE	0.001** (2.17)	-0.000 (-1.58)	0.000** (2.27)	0.001 (1.52)
CO2_PER_CAPITA	-0.008*** (-8.15)	-0.002*** (-3.17)	0.002*** (3.43)	-0.008*** (-5.50)
CORRUPT_CONTROL	-0.020*** (-3.46)	-0.007* (-1.80)	0.016*** (4.32)	-0.012 (-1.29)
GOV_EFFECT	0.009** (1.97)	0.002 (0.50)	0.010*** (3.23)	0.022*** (2.85)
POL_STABILITY	-0.027*** (-7.17)	-0.010*** (-4.82)	0.007*** (3.10)	-0.029*** (-5.16)
REGULATE_QUAL	0.002 (0.26)	-0.006 (-1.62)	0.018*** (4.84)	0.011 (1.16)
RULE_LAW	0.003 (0.43)	-0.003 (-0.83)	-0.039*** (-9.44)	-0.042*** (-3.96)
VOICE_ACCOUNT	0.007 (1.13)	0.010*** (3.07)	-0.011*** (-2.93)	0.006 (0.70)
CTR	0.049* (1.72)	-0.030 (-1.41)	0.081*** (4.14)	0.095* (1.91)
SIZE	-0.008*** (-26.14)	-0.016*** (-37.75)	-0.008*** (-21.40)	-0.032*** (-37.07)
LEV	0.002* (1.90)	0.003*** (2.74)	-0.001 (-0.98)	0.003* (1.65)
ROA	-0.067*** (-11.66)	-0.022*** (-4.09)	0.143*** (30.53)	0.052*** (4.35)
CASH	0.115*** (26.44)	0.113*** (21.94)	0.063*** (14.40)	0.292*** (27.16)
PPE	-0.015*** (-9.24)	-0.013*** (-7.01)	-0.009*** (-5.02)	-0.037*** (-9.17)
INTANG	-0.030*** (-6.53)	0.010 (1.43)	-0.006 (-1.13)	-0.027** (-2.04)
FOREIGN	0.001 (1.25)	0.002** (2.19)	-0.002** (-2.02)	0.002 (0.75)
R&D	0.039*** (3.60)	0.346*** (18.64)	-0.018* (-1.73)	0.372*** (11.78)
SGA	-0.003*** (-4.94)	0.041*** (32.97)	-0.005*** (-9.61)	0.035*** (19.65)
CAPEX	0.096*** (13.71)	0.162*** (21.18)	0.115*** (15.90)	0.373*** (22.50)
COVID19	-0.078*** (-21.24)	-0.004* (-1.84)	-0.008*** (-3.51)	-0.090*** (-15.62)
Industry fixed effect	Yes	Yes	Yes	Yes
Country fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
N	249,711	249,711	249,711	249,711
Adjusted R-squared	0.086	0.392	0.121	0.224

Note(s): *, ** and *** denote significant level at the 0.1, 0.05 and 0.01 levels, respectively, using two-tailed *p*-values

The results (untabulated) indicate that the coefficients for *COUNTRY_NETZERO*SOCIAL_SCORE* are negative and statistically significant for *REM_CFO*, *REM_DISEXP* and *REM_SUM*. However, the coefficients for *COUNTRY_NETZERO*ENVRN_SCORE* and *COUNTRY_NETZERO*CORPGOV_SCORE* are statistically insignificant. These findings suggest that the main results of *H2*, which show a negative relation between *COUNTRY_NETZERO*CSR* and *REM* activities, are primarily driven by higher social scores, indicating a greater societal concern.

In conclusion, although firms affected by country-level net zero target commitment may have incentives to engage in *REM* to transition and finance required investments, the results provide evidence that socially responsible firms are less likely to engage in *REM* activities. This suggests that firms voluntarily adopting more socially responsible practices are better prepared to commit to the headquarter country's net zero target commitment and are less inclined to engage in questionable corporate practices such as earnings management.

5.4 Firm-level net zero target commitment

In relation to firm-level net zero target commitment, we manually collect the net zero target data from the websites of the top 2,000 firms in the world based on their market capitalizations (Kim, 2024). The sample period covers 2011–2021, and we exclude the US

firms from our main analysis because of the dominance of the US-listed firms in the sample of this global study [14]. The variable of interest (*FIRM_NETZERO*) is coded as 1 if a firm has voluntarily committed to the net zero targets, and 0 otherwise. If a firm has voluntarily committed to the net zero targets, it is highly likely that such a firm is either capable of reducing its carbon footprint and/or will be able to achieve the target without having to engage in more earnings management. As reported in Table 8, we do not document any statistically significant association between *FIRM_NETZERO* and each of the four measures of REM. These results provide support for the proposition that firms that voluntarily commit to the net zero targets do not exhibit higher REM, consistent with the notion that such firms are better prepared to deal with the regulatory changes imposed by the country where they are headquartered [15].

While a country's net zero target commitment serves as an exogenous regulatory shock for firms headquartered in the country, firms can also voluntarily commit to the net zero targets. To address the identification issue and mitigate the potential endogeneity problem, we exclude firm-year observations that voluntarily committed to a net zero target from our main sample and rerun our analysis. The number of such firms only accounts for 0.5% of the 2,000 firms for which we hand-collected the firm-level voluntary commitment data. Our

Table 8. Firm-level net zero target commitment

Dependent variable	<i>REM_CFO</i>	<i>REM_DISEXP</i>	<i>REM_PROD COST</i>	<i>REM_SUM</i>
<i>CONSTANT</i>	0.261 (1.23)	0.203* (1.78)	0.040 (0.33)	0.503 (1.56)
<i>FIRM_NETZERO</i>	0.001 (0.15)	0.003 (0.40)	-0.007 (-0.82)	-0.003 (-0.19)
<i>CLIMATE_RISK</i>	0.000 (0.92)	-0.000* (-1.83)	-0.000 (-0.23)	0.000 (0.12)
<i>GDP_PER_CAPITA</i>	-0.040 (-1.42)	-0.003 (-0.24)	0.008 (0.46)	-0.036 (-0.85)
<i>GDP_GROWTH_RATE</i>	-0.001 (-0.72)	-0.000 (-0.89)	0.001 (1.07)	-0.001 (-0.46)
<i>CO2_PER_CAPITA</i>	0.002 (0.39)	0.002 (0.64)	0.005** (2.02)	0.009 (1.12)
<i>CORRUPT_CONTROL</i>	0.015 (0.65)	0.009 (0.87)	-0.019 (-1.43)	0.005 (0.15)
<i>GOV_EFFECT</i>	-0.021 (-0.88)	-0.002 (-0.22)	0.007 (0.58)	-0.016 (-0.49)
<i>POL_STABILITY</i>	-0.007 (-0.41)	-0.006 (-0.68)	0.013 (1.27)	-0.000 (-0.00)
<i>REGULATE_QUAL</i>	0.076** (2.13)	0.006 (0.45)	0.002 (0.15)	0.084* (1.91)
<i>RULE_LAW</i>	-0.083* (-1.96)	0.008 (0.42)	-0.005 (-0.27)	-0.080 (-1.38)
<i>VOICE_ACCOUNT</i>	0.010 (0.25)	0.034 (1.64)	0.000 (0.00)	0.044 (0.77)
<i>CTR</i>	0.295* (1.75)	0.029 (0.38)	0.110 (1.29)	0.434* (1.91)
<i>SIZE</i>	-0.005** (-2.38)	-0.015*** (-4.56)	-0.009*** (-2.73)	-0.029*** (-4.25)
<i>LEV</i>	0.007 (1.46)	0.007 (0.93)	0.005 (0.59)	0.018 (1.14)
<i>ROA</i>	0.469*** (11.57)	0.262*** (4.11)	0.587*** (9.64)	1.319*** (10.11)
<i>CASH</i>	0.079*** (2.63)	-0.031 (-0.77)	0.032 (0.85)	0.079 (0.96)
<i>PPE</i>	0.013 (1.12)	0.004 (0.26)	0.009 (0.68)	0.026 (0.88)
<i>INTANG</i>	0.008 (0.32)	0.001 (0.03)	-0.012 (-0.37)	-0.003 (-0.05)
<i>FOREIGN</i>	-0.006 (-1.21)	-0.006 (-1.65)	-0.018*** (-4.51)	-0.030*** (-3.29)
<i>R&D</i>	0.052 (1.28)	0.608*** (3.79)	0.301*** (2.81)	0.961*** (3.60)
<i>SGA</i>	-0.011 (-1.28)	0.184 (1.54)	0.124 (1.51)	0.298 (1.47)
<i>CAPEX</i>	0.039 (0.64)	0.120 (1.61)	0.086 (1.39)	0.245 (1.61)
<i>COVID19</i>	0.004 (0.47)	-0.017*** (-2.86)	0.005 (0.70)	-0.008 (-0.52)
Industry fixed effect	Yes	Yes	Yes	Yes
Country fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
<i>N</i>	5,241	5,241	5,241	5,241
Adjusted R-squared	0.138	0.577	0.437	0.425

Note(s): *, ** and *** denote significant level at the 0.1, 0.05 and 0.01 levels, respectively, using two-tailed *p*-values

results (untabulated) remain consistent with our main findings after the exclusion of these observations in that the coefficient on *COUNTRY_NETZERO* remains positive and statistically significant across all REM measures [16].

Overall, these findings, combined with the results reported in Table 8 that show an insignificant relation between firm-level voluntary commitment and REM, provide evidence that, irrespective of whether firms voluntarily commit to the net zero targets or not, the country-level commitment of net zero drives REM among firms headquartered in those countries. Importantly, these results suggest that our main findings are less likely to be affected by endogeneity concerns.

5.5 Additional analyses using alternative definitions of net zero variable

We conduct a number of additional analyses. First, we redo the main analysis with an alternative definition of the net zero variable. Using the full sample used in our main analysis, we recode the net zero variable *LAW/POLICY_1* as one if the net zero commitment of a particular country is either in law or in the official policy document, and zero otherwise (including either declaration/pledge or discussion/proposal or no commitment to net zero transition). Our results (untabulated) provide support to our main findings in showing that the variable *LAW/POLICY_1* is positively and significantly associated with three measures of REM (*REM_CFO*: coefficient = 0.016, p -value < 0.01; *REM_DISEXP*: coefficient = 0.005, p -value < 0.10; *REM_SUM*: coefficient = 0.020, p -value < 0.01).

Second, to complement the above test and further ascertain the robustness of our results, we restrict our sample to only firms located in countries that commit to net zero target (i.e. we remove observations related to firms in countries that do not commit to net zero), and recode the net zero variable *LAW/POLICY_2* as one if the net zero commitment of a particular country is either in law or in the official policy document, and zero if it is in either declaration/pledge or discussion/proposal. We rerun our main analysis with the restricted sample using this alternative definition of the net zero variable. Our results (untabulated) show a positive and statistically significant relation between *LAW/POLICY_2* and three measures of REM (*REM_CFO*: coefficient = 0.047, p -value < 0.05; *REM_DISEXP*: coefficient = 0.033, p -value < 0.10; *REM_SUM*: coefficient = 0.063, p -value < 0.05).

Finally, to ascertain the robustness of our results, we rerun our analysis on the intensity of net zero commitment using the raw scores of the commitment levels (*INTENSITY_NETZERO_RAW*), i.e. 4 (in law), 3 (policy document), 2 (declaration/pledge) and 1 (proposed/in discussion). Countries that do not commit to the net zero target are coded zero. The results (untabulated) show a positive and significant relation between *INTENSITY_NETZERO_RAW* and all four measures of REM at the 1% level.

Collectively, these results provide support for our main findings in showing that firms headquartered in countries that commit to net zero exhibit higher REM. Importantly, the findings are in line with the proposition that as the intensity of the net zero commitment of a country increases (i.e. if the commitment level is in either in law or in the policy document), firms in those countries are more likely to use REM to cope with the financial burden of operational transformation required to achieve the net zero targets. In addition, these results also indicate that our findings are less likely to be driven by the arbitrary definition of the intensity of net zero commitment.

5.6 Effect of the net zero target commitment on accruals-based earnings management

As an additional test, we explore whether firms resort to accruals-based earnings management (ABEM) when the countries in which they are headquartered commit to a net zero target. Given that the reduction of CO₂ emissions necessitates operational

transformation and significant investment, we hypothesize that such firms are more likely to seek government financial support to cover the costs of transformation. Firms headquartered in countries that have committed to a net zero target may engage in income-decreasing accruals-based earnings management. They may use this accounting technique during the initial years following their home country's commitment to the net zero targets to persuade the government to offer financial support. Following the methodology of Kothari *et al.* (2005), Lai *et al.* (2018), Peasnell *et al.* (2000) and Van Caneghem (2002), we use a performance-adjusted version of the Modified Jones Model (Dechow *et al.*, 1995) as the measure of ABEM. To test our hypothesis, we use signed discretionary accruals (*DISACC*) as the dependent variable.

The descriptive statistics in Table 2 show that the mean (median) for signed values of discretionary accruals (*DISACC*) is 0.008 (0.006). The two-sample *t*-test results (untabulated) indicate that the mean value for signed discretionary accruals (*DISACC*) in countries that have committed to a net zero target (mean value = -0.0012) is lower than in countries that have not (mean value = 0.0092). This suggests that firms impacted by country-level net zero target commitment manage earnings downwards through discretionary accruals. In addition, there is a significant negative correlation at the 1% level between *COUNTRY_NETZERO* and *DISACC*. The regression results presented in Table 9 show a significant and negative association between *COUNTRY_NETZERO* and *DISACC* (coefficient = -0.006, *p*-value < 0.01). This supports the postulate that firms headquartered in countries committed to a net zero target are likely to manage accrual earnings downwards. This could be a strategy to seek financial support from their governments to fund the costs of operational transformation.

In addition, we conducted an analysis of firm-level net zero target commitment using a sample of 5,241 observations. The coefficient on *FIRM_NETZERO* is also negative, but not statistically significant. This suggests that firms voluntarily committing to the net zero targets are more prepared and committed to meeting their headquarter country's net zero target and do not manipulate their accruals more relative to previous years or compared to other firms.

6. Conclusion

This study explores the financial reporting implications for firms headquartered in countries that have committed to a net zero target. The commitment to a net zero target by a country is a regulatory shock that is anticipated to have a financial impact on firms and influence their decisions, particularly those related to REM. To examine the financial impact of country-level net zero target commitment, we analyze a global sample of publicly listed firms for the period from 2011 to 2021. The findings suggest that firms headquartered in countries that have committed to a net zero target are more likely to engage in REM activities.

The performance of a firm's CSR is expected to influence its decision to engage in REM. Therefore, we use the CSR score as a moderating factor in the relation between the net zero target commitment and REM. The findings indicate that CSR performance is negatively related to REM activities. Given that CSR comprises three components – environmental, social and corporate governance – and each can have a varying effect on REM, we conduct a separate analysis of CSR performance by including these individual components separately in the regression models. Our findings suggest that firms with higher social scores engage in less REM. The main findings remain robust when applying the PSM methodology to control for differences in firm characteristics.

We also conduct several additional analyses to investigate the financial reporting consequences of net zero target commitment. We introduce the intensity of the net zero target commitment by headquarter countries as an additional measure of regulatory shocks.

Table 9. Effect of the net zero target commitment on accrual-based earnings management

Variables	DISACC	DISACC
	<i>COUNTRY_NETZERO</i>	<i>FIRM_NETZERO</i>
CONSTANT	0.266*** (14.76)	0.279*** (4.00)
<i>COUNTRY_NETZERO</i>	-0.006*** (-5.25)	
<i>FIRM_NETZERO</i>		-0.005 (-0.87)
<i>CLIMATE_RISK</i>	-0.000 (-0.58)	-0.000 (-0.99)
<i>GDP_PER_CAPITA</i>	-0.020*** (-8.61)	-0.035*** (-3.45)
<i>GDP_GROWTH_RATE</i>	0.001*** (7.50)	0.000 (0.12)
<i>CO2_PER_CAPITA</i>	0.000 (0.67)	0.000 (0.20)
<i>CORRUPT_CONTROL</i>	0.009*** (3.72)	-0.011 (-1.19)
<i>GOV_EFFECT</i>	-0.011*** (-5.08)	-0.005 (-0.61)
<i>POL_STABILITY</i>	-0.003** (-2.05)	0.008 (1.37)
<i>REGULATE_QUAL</i>	0.008*** (2.95)	0.004 (0.41)
<i>RULE_LAW</i>	0.020*** (6.97)	0.011 (0.84)
<i>VOICE_ACCOUNT</i>	-0.009*** (-3.17)	-0.018 (-1.08)
<i>CTR</i>	-0.040*** (-3.12)	-0.027 (-0.49)
<i>SIZE</i>	-0.005*** (-27.05)	-0.000 (-0.08)
<i>LEV</i>	-0.002*** (-4.06)	-0.006** (-2.08)
<i>ROA</i>	0.232*** (73.41)	0.144*** (5.08)
<i>CASH</i>	-0.034*** (-14.61)	-0.079*** (-4.63)
<i>PPE</i>	-0.030*** (-32.60)	-0.044*** (-6.47)
<i>INTANG</i>	-0.086*** (-34.24)	-0.072*** (-5.12)
<i>FOREIGN</i>	-0.000 (-0.13)	0.005** (1.98)
<i>R&D</i>	0.021*** (3.54)	-0.028 (-0.61)
<i>SGA</i>	0.004*** (12.45)	0.002 (0.42)
<i>CAPEX</i>	-0.024*** (-6.88)	-0.040 (-1.40)
<i>COVID19</i>	0.009*** (4.89)	-0.005 (-1.01)
Industry fixed effect	Yes	Yes
Country fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
<i>N</i>	249,711	5,241
Adjusted R-squared	0.162	0.175

Note(s): *, ** and *** denote significant level at the 0.1, 0.05 and 0.01 levels, respectively, using two-tailed *p*-value

The results indicate that a higher commitment level is positively associated with REM activities. In addition, we rerun our main analysis using firm-level net zero target commitment as the main variable of interest. Given that firm-level commitment to the net zero targets is voluntary, as expected, the results suggest that such firms are not associated with higher REM activities, suggesting better preparedness and willingness of such firms to meet the net zero targets.

To further test the effect of net zero target commitment on earnings management activities, we use signed Accruals-Based Earnings Management (ABEM) as the dependent variable. The findings show that country-level net zero target commitment is negatively related to ABEM activities. This suggests that firms headquartered in countries that have committed to a net zero target engage in income-decreasing earnings management. Reporting lower accrual earnings in the years of net zero target commitment could help firms negotiate financial subsidies and support from the governments of the countries where they are headquartered.

Overall, the findings of our study suggest that managers of firms headquartered in countries that have committed to a net zero target use their operational discretion, including accounting and long-term investment discretion, to engage in REM and ABEM activities as they are required to comply with regulatory changes and transform their operations to support the net zero target of their headquarter country. Our findings provide empirical evidence of managerial opportunism in dealing with the financial implications on these publicly listed firms as a result of countries' commitment to a net zero target.

Our findings need to be interpreted with caution. First, our measure of the intensity of net zero commitment using square values of the raw intensity score is based on the underlying assumption that a stronger commitment increases exponentially with a different level of intensity. To the extent that this measure appropriately captures the incremental effect of the intensity of net zero commitment, we acknowledge the inherent arbitrary nature of this proxy. In this regard, we model our intensity variable in a similar spirit to studies that model the convex effects of environmental policy stringency (e.g. [Kalamova and Johnstone, 2012](#); [Wolde-Rufael and Mulat-Weldemeskel, 2021](#)). In addition, the results of our additional tests indicate that our findings are less likely to be driven by the arbitrary definition of the intensity of net zero commitment.

Second, our study is subject to data-availability constraints related to our CSR performance variable, which results in a substantial reduction in our sample for the test of our second hypothesis. We acknowledge that this limitation may have implications for the generalizability of our findings. Specifically, our results should be relevant in research settings that focus on large global firms that are likely to be covered by the Refinitiv database.

The findings of our study have important implications for firms, regulators and investors. First, we show an unintended consequence of net zero commitments: while these commitments are designed to accelerate the low-carbon transition, they can also increase managers' incentives to engage in REM, potentially distorting operating decisions and masking the true economic cost of transition. This suggests that regulators and standard setters designing net zero frameworks may need to consider complementary safeguards for financial reporting quality (e.g. enhanced disclosure or assurance around major operating adjustments during the transition period). Second, boards, audit committees and auditors should recognize that the period surrounding net zero commitments is one of elevated REM risk and adjust their monitoring and audit procedures accordingly. Third, investors and other users of financial statements may need to interpret short-term performance metrics with caution in the wake of net zero commitments, as reported earnings may partly reflect real activities manipulation rather than underlying performance.

Our study also provides several interesting avenues for further research. For example, future studies could examine the impact of subsequent changes in government policies related to the net zero targets and the possible challenges for firms in meeting these targets. In addition, future work could examine which specific real activities (e.g. R&D, advertising, production) are most affected by net zero commitments, and whether particular institutional features such as enforcement strength, climate disclosure regimes or executive compensation structures mitigate or exacerbate the REM response. More broadly, our setting offers a laboratory for studying how major societal or regulatory commitments interact with firms' operating decisions and reporting quality.

Notes

- [1.] The release of greenhouse gas (GHG) emissions into the atmosphere has been a significant contributor to the phenomena of global warming and climate change

(Dehghani-Sani & Bahadori, 2021; Hook & Tang, 2013). As a result of climate change, the rise in temperatures has had far-reaching impacts on numerous facets of human life, including the trajectory of global economic growth. The [World Economic Forum \(2022\)](#) has expressly ranked “climate action failure” and “extreme weather” as the most serious and second-most serious global risks, respectively, for the upcoming decade. These threats, in turn, prompt countries to commit to a net zero target.

- [2.] For countries that have committed to a net zero target, the governments introduce public policy interventions aimed at businesses, requiring them to modify their operations in line with the net zero target ([PwC Global, 2021](#)). The policy interventions encompass various measures, such as prohibiting and phasing out high-pollution activities, reforming fossil fuel subsidies, implementing taxation measures, setting standards for new products and fuel and enforcing mandatory disclosure of environmental, social and governance (ESG) performance and climate risk. These interventions aim to address and mitigate the environmental impact of industries and promote sustainability practices in businesses.
- [3.] In addition to governmental pressure, some notable financial institutions and investors have also begun advocating for net zero targets, thereby requiring firms to reduce carbon emissions. This demonstrates their commitment to a net zero investment portfolio by allocating their assets to firms dedicated to reducing their carbon footprints ([Energetics, 2021](#)). Consequently, the race to achieve a net zero target prompts countries and firms to take the necessary steps to mitigate the risks of destruction caused by climate change ([United Nations, 2020](#)). Therefore, the issue of net zero target commitment and its consequences are worthy of investigation, given that the transition to net zero necessitates substantial financial commitments from both countries and firms.
- [4.] Most studies on REM have primarily focused on the opportunistic reduction of research and development (R&D) expenditures to decrease corporate expenses ([Roychowdhury, 2006](#)). For instance, [Dechow and Sloan \(1991\)](#) suggested that CEOs reduce spending on R&D to increase short-term earnings toward the end of their tenure. This view is supported by [Baber et al. \(1991\)](#) and [Bushee \(1998\)](#), who find that managers decrease R&D expenditures to meet earnings benchmarks. A survey by [Graham et al. \(2005\)](#) documents that 80% of managers would reduce R&D, advertising and maintenance expenditures to meet short-term earnings targets. Furthermore, 55% of managers claim that they would postpone a new project with positive net present value, even though such REM may sacrifice firm value in future periods. This suggests that managers are more likely to smooth earnings through REM, even though it may negatively affect firms’ long-term profitability.
- [5.] A recent meta-analysis study by [Klaaßen and Steffen \(2023\)](#) investigates the required technology-level investment shifts for climate-relevant infrastructure until 2035. The study documents a steep uptick in overall investment required, with approximately €300bn investment needed in 2021–2025, representing an increase of €87bn compared to the previous five years.
- [6.] To further illustrate the practical relevance of our research, we have now provided some anecdotal evidence of how the net zero target commitment has exerted non-trivial financial pressure on affected firms. Several of Europe’s largest steelmakers such as ArcelorMittal Europe, ThyssenKrupp and SSAB announced net zero emissions target and implement relative emissions reduction strategies. For example, ArcelorMittal Europe set the route to achieve net zero target by 2050, through breakthrough technologies at the forefront of the firm’s roadmap for steelmaking decarbonization. Especially, “Smart Carbon” is a carbon neutral steelmaking route that leverages all clean energies (e.g. circular carbon, clean electricity and carbon capture and storage) within the high temperature-controlled reduction environment of steel making. Another route is direct reduced iron, which involves moving from using predominantly natural gas, to hydrogen as the key reductant in steel making. With growth in the supply of green hydrogen, the steelmaking process comes close to carbon neutrality. By investing in both routes, ArcelorMittal Europe can significantly reduce GHG emissions for moving toward the net zero emissions target achievement ([ArcelorMittal, 2022](#)).

In December 2024, however, ArcelorMittal has announced a delay in its planned green steel investments due to challenges posed by regulatory uncertainty and the substantial economic pressures that the firm faces in achieving emissions targets.

- [7.] The significant reduction on the sample size with CSR score is because of the limited availability of CSR score for the sample firms. Refinitiv (formerly ASSET4) is a leading corporate social responsibility database which has been extensively used in the prior literature investigating CSR-related issues in different country settings (see, e.g. [Chen et al., 2025](#); [Cheng et al., 2014](#); [Dyck et al., 2019](#); [Ferrell et al., 2016](#)). The substantial reduction in the sample size observed in our study after merging with the Refinitiv ESG database is not uncommon and largely consistent with prior studies examining CSR at the international level (e.g. [Chen et al., 2025](#); [Cohen et al., 2023](#)). For example, [Chen et al. \(2025\)](#) experienced an approximately 87% decrease in their sample when they incorporate the ESG performance data from ASSET4, which is comparable to that of our study.
- [8.] The use of square values indicates a stronger commitment that increases exponentially with a different commitment level. Squaring allows us to model the *convex escalation* in regulatory intensity, where the difference between 3 (policy document) and 4 (law) is assumed to be much larger than the difference between 1 (proposal) and 2 (pledge). The refined score represents the different commitment levels for the net zero target, with the assumption that the impact of net zero target commitment in law (score of 16) is significantly more than the impact when it is in the policy document (score of 9) or is a declaration/pledge (score of 4).
- [9.] We acknowledge that some studies in this literature report the mean values of the REM measures that are close to zero. One possible explanation to this observation is that this difference in descriptive statistics could be driven by the underlying nature of the sample, i.e. an inherent difference in the research setting. Specifically, most of these prior REM studies are conducted in the US setting whereas our study is based on 71 countries with the exclusion of the USA from the main sample to avoid potential dominance of results given its significant market size and number of observations in the global study. We have also carefully reviewed the REM literature and documented a number of studies that show comparable mean values of the REM measures to those reported in our paper. For example, in a study by [Kim and Sohn \(2013\)](#), the mean values of abnormal cash flow from operations, abnormal production costs and abnormal discretionary expenditures are 0.069, 0.143 and 0.141, respectively.
- [10.] Results are consistent when only firms headquartered in countries that have committed to a net zero target are included in the sample. For example, the coefficient on *REM_SUM* is 0.072 and is significant at the 1% level (t -stat = 11.32). Similarly, the coefficients on *REM_CFO*, *REM_PRODCOST* and *REM_DISEXP* are positive and statistically significant at the 1% level. Results are not tabulated to conserve space.
- [11.] To ascertain the robustness of our main findings, we exclude the control variables *CASH*, *SGA* and *R&D* from our main model, and rerun our analysis. The results (untabulated) show that *COUNTRY_NETZERO* remains positively and significantly related to all four measures of *REM* at the 1% level.
- [12.] Models also use vulnerability index developed by the index of climate vulnerability for a firm in a specific country as an alternative to climate risk measure. The University of Notre Dame Global Adaptation Index uses three cross-cutting elements as the measures of climate vulnerability: the exposure of the sector to climate-related or climate-exacerbated hazards; the sensitivity of the sector to hazardous impacts and the adaptability of the sector to solve with or adapt to these impacts.
- [13.] The results remain consistent for the test of *H2* when an alternative proxy for CSR score is included in all the models, using the country-level readiness index. This readiness index, developed as part of the University of Notre Dame's Environmental Change Initiative, measures a country's ability to effectively leverage investments in adapting to the effects of climate change. The inclusion of this alternate CSR proxy further strengthens the findings and provides

additional support for the conclusion that firms with higher CSR performance are better equipped to handle the challenges associated with the net zero target commitment in their respective countries. It underscores the importance of sustainable business practices and preparedness in navigating the implications of climate change initiatives and reduces the likelihood of engaging in real earnings management practices as a response to such external pressures.

- [14.] Because US-listed firms comprise almost 50% of the sample, these firms are excluded from the main sample so that the results are not dominated by the US firms. Our results based on US sample are statistically similar to our main findings.
- [15.] Using a sample of firm-level net zero target commitment, we apply a difference-in-differences (DiD) approach, considering the country-level commitment as the pre- and postcommitment years and incorporating firm-level commitments in a staggered approach. The results from our DiD analyses are in line with the main findings using firm-level commitment data. However, even when we include *COUNTRY_NETZERO* in the same model, the results for *FIRM_NETZERO* remain insignificant.
- [16.] One possible solution to address the endogeneity concern is to include a firm's voluntary commitment to the net zero targets as a control variable in our main model, and rerun our analysis. However, in refining our model to conduct this analysis, we face an inherent data availability issue given that our analysis of firm-level commitment is restricted to the top 2,000 firms by market capitalizations. Importantly, all 2,000 firms in this subsample are headquartered in the country that has committed to the net zero targets, and as a result, the value of the variable *COUNTRY_NETZERO* is equal to 1 in both subsamples of firms that have voluntarily committed to the net zero targets and those that did not voluntarily commit to the net zero targets. Therefore, with this limitation, we are not able to draw any meaningful inference from the test with the inclusion of a firm's voluntary commitment to the net zero targets a control variable in our main model.

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Supplementary material

The supplementary material for this article can be found online.

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